

FRIEDENWALD (H.)

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The subject of this paper, though long known in medical literature, has only in late years received much attention. American text-books on otology, with few exceptions, mention it in short paragraphs. And while special journals contain many contributions to the subject, it has not been brought sufficiently before the profession in journals devoted to medicine in general.¹ It is needless to add that the subject is not understood by the profession as it deserves to be.

And yet this disease was found by Virchow² in nearly one-third of the number of fatal cases of ear-trouble. This fact alone should make it an object deserving careful study. Its many peculiarities, and the ingenious and varying theories as to its nature, add greatly to the interest.

The disease presents itself as a bright, white growth of pearly luster. Its surface is smooth. On

¹ The following publications are the only ones I could find. Orne Green: Boston, Med. and Surg. Journal, 1881, on Desquamative Inflammation of the Middle Ear. Randall: Journ. Am. Med. Assoc., 1890, on Cholesteatoma of the Ear.

² Quoted by Bezold, Arch. of Otol., vol. xix, p. 233.



handling it readily breaks up into distinct layers, which are placed concentrically over each other. It contains no blood-vessels, and, when examined with the microscope, is seen to be made up of layers of large, flat, non-nucleated, polyhedral cells, which lie stratified in layers that cling more or less firmly to each other. These cells are in every respect similar to the cells of the outer layers of epidermis. Between the layers of cells we usually find cholesterol crystals.

Such growths are found in the middle ear—in the tympanum and in the mastoid cells. They lie in these cavities, which are frequently enlarged, and closely fill them, so as to show accurately the configuration of the cavity in their form. The cavities are smooth, unless they have become carious. They are lined with a very thin membrane, which consists of a layer of periosteum, upon which lies a rete Malpighii, just as in the skin, and which gradually passes over into flatter and flatter cells that finally lose their nuclei and become the flat cells described already. The latter are placed directly upon the lining membrane, which must be regarded as the capsule that surrounds and produces the growth.

This epidermic growth is known as “cholesteatoma,” a name given it by Johannes Müller,¹ because of the cholesterol crystals, which he looked upon as the characteristic feature of the growth. It is also called “pearl tumor” (Cruveilhier²) or

¹ Ueber d. feineren Bau d. Geschwülste, 1838.

² Anat. Path., liv. ii.

“margaritoma,” (Virchow¹) from its peculiar pearly luster. This it owes to the interference of light by the many fine layers of cells.

The growth varies greatly in size ; it may be smaller than a pea or as large as a hen’s egg. In practice it is often difficult to decide whether a small collection of flattened epidermic cells in the middle ear is or is not a cholesteatoma.

The growth is most frequently found in the upper and posterior part of the tympanic cavity, but it often extends into the mastoid cells, where it distends the bony cavities by pressure, and where it may perforate the bone externally, or internally, into the cranial fossa. Politzer recently reported a case in which the large growth filled the middle ear, part of the mastoid and part of the auditory canal, and in which it had destroyed the entire internal ear.²

Cholesteatoma is often found associated with chronic suppuration of the middle ear, with perforation or destruction of the drum-head, and with polypi of the middle ear. It often develops long after this disease has run its course. But the growth has been found without any other or any previous disease of the ear, and with a normal drum-head. As is well known, it occurs in other parts of the body ; it has been found in other cranial bones, in the brain, in the spinal cord, in the mamma, the ovary and the testicle.

The epidermic growth, which we have thus found to form in the tympanic cavity and the mastoid

¹ Virchow’s Archiv, 1855, vol. viii.

² Wien. med. Wochenschr., 1891.

cells, would appear to be a heterologous tumor, for the middle ear is lined by a mucous membrane, which consists partly of columnar and ciliated cells, as in the Eustachian tube, and partly of much-flattened non-ciliated cells.

The explanation of the presence of epidermis in such spaces as the middle ear and mastoid cells is not easily given. Various theories have been advanced. Before we consider them we shall study the clinical aspect as presented by a few cases.

CASE I.—A gentleman, aged twenty three, first seen March 23, 1891, had had for two months ringing in the right ear and a slight but very offensive discharge. He had had ear-trouble previously, and had been slightly deaf for a long time. Tests for hearing: Watch, 4 cm.; whisper, 0; and voice, 8 m.; Rinné, positive; tuning-fork in Weber's experiment heard in the right ear. After cleaning the external auditory canal, which contained much white, cheesy-looking matter, I found that there was a perforation, about 2 mm. in diameter, in the upper part of the drum, just above the prominent point of the handle of the malleus, known as the short process. The perforation lay in that part of the drum-head called Shrapnell's membrane, or the *membrana flaccida*, from its fine structure. By means of a fine Hartmann canula, which was passed through this perforation, a great quantity of white matter was washed out of the cavity situated beyond. After getting the cavity as clean as possible, it was dried by cotton, and iodoform was then carried into the cavity through the opening. This treatment was kept up at intervals for about four weeks. Less and less matter could be washed out of the cavity, and the discharge ceased entirely;

at the last visit the cavity seemed to be perfectly clean; the hearing had improved. The white matter was cholesteatomatous substance.

Perforations in Shrapnell's membrane are not common. They are often found with little or no affection of the rest of the drum, the disease seeming to run its course in the small space in the upper part of the middle ear, between the malleus and the outer wall. This space frequently does not communicate with the rest of the middle ear, or communicates only in the posterior part, so that blind sacs are formed. These perforations are associated with a form of suppurative inflammation which is very chronic, and which, from the proximity to the brain and the thinness of the intervening plate of bone, is exceedingly dangerous to life. Their chronicity is due, according to Bezold, to the fact that "stratified epidermis is constant behind these perforations."¹ Many observers have called attention to the frequency of cholesteatomatous masses in the attic (or upper part of the middle ear) in these cases.² It is true that these epidermoid cells often form only irregular masses, while the typical cholesteatoma is composed of regular layers. Nevertheless, it seems impracticable to make a clinical distinction, as it is impossible to find a sharp pathologic difference.

CASE II.—A young man, aged twenty-one, applied at the City Hospital Dispensary for treatment July

¹ Arch. of Otolgy, vol. xix, p. 246.

² See Kretschmann (Arch. f. Ohrenh., xxv; reviewed in Arch. of Otol., xvii, p. 263), and others.

13, 1891, complaining of a discharge he had from the right ear since childhood ; which had had its origin in some severe illness (bilious fever?). He had been treated for a long time by different physicians, without any improvement. Several polypi were found, which were scraped off with the curette, and some pieces of dead bone were then likewise removed. After this had been accomplished, a white substance was seen in the upper part of the middle ear. It could not be removed by injection alone, but had first to be dislodged by probes. The large cavity, which was then exposed, was further cleaned, and it was then seen that the whole attic of the middle ear was exposed, the plate of bone forming part of the outer boundary of the middle ear having been entirely destroyed. The ossicula were also lost. At first the patient was treated with a mixture of iodoform and benzoin, but after the cholesteatoma was removed there was no discharge, excepting once for a few days. After removing a small polypus which had returned, the discharge ceased. I then saw the patient at intervals of several weeks for a few months, and at the last examination I found but little epidermis in the water, after washing out the middle ear.¹ He heard the watch on firm contact. His left ear is normal, but there is a small opening in Shrapnell's membrane—as was likewise found in Case I, in the healthy ear. The fact has been pointed out by Walb and by Bezold, that it is not uncommon to find “on one side a perforation of Shrapnell's membrane with suppuration, on the other side a small aperture at the upper pole of the middle ear.”²

¹ Recently the patient again returned to the Dispensary with a slight discharge.

² Arch. f. Ohrenh., xxvi, p. 185.

I submitted some of the slides prepared from the matter removed in Case II to Professor N. G. Keirle, pathologist of the City Hospital. He agreed that the substance removed from the ear was composed of typical cholesteatomatous cells.

In Case II we have the cholesteatoma in the same location as in Case I, but it has enlarged, encroached on the walls, and destroyed the outer wall entirely.

CASE III has already been published under the title of "A Case of Extensive Caries and Cholesteatoma of the Mastoid Process, without Local Signs of Inflammation; Death from Thrombosis of the Lateral Sinus and Meningitis."¹ I shall refer only to those points which bear upon the subject under discussion. The patient, a young man, had had chronic suppurative inflammation of the middle ear since childhood. He had many polypi; there was a slight but very offensive discharge. An attack of severe pain came on about the middle of March, 1890, and the patient was not able to work for about five weeks, when he apparently recovered, and considered himself well again. This period of quiet lasted only about five weeks, when pyemia, due to erosion of the lateral sinus, suddenly set in, from which the patient died. The *post-mortem* examination, which Professor Keirle had the kindness to make, showed that there was a large cavity in the temporal bone, which had been filled by a cholesteatomatous growth. This cavity occupied almost the whole mastoid process, and had ulcerated this bone both externally and internally, thus opening the lateral sinus. This case shows the extent to which these tumors grow, though, as I have mentioned, they may become much larger still.

¹ Arch. of Otology, vol. xx, p. 1.

In this case there was extensive caries, and the tumor had partly degenerated, especially that part nearest the middle ear.

I wish to mention, parenthetically, that small collections of cholesteatoma were found in the lateral sinus at a considerable distance from the point of erosion.

The three cases related are examples of various degrees of this affection; other cases, similar to them or intermediate in degree, might be described. I shall furnish only one more, which will illustrate the serious symptoms that may arise from the presence of a small cholesteatoma:

CASE IV.—The patient, aged about forty-five years, had had a discharge from the right ear for three or four years. The ear-trouble followed an affection of the throat. During the last year he had had several very severe attacks of pain, which were treated by several physicians with various instillations. When I was called in through the kindness of his family physician, Dr. C. H. Jones (May 6, 1892), I learned that the man had been sick for several weeks, suffering with great pain in the ear and head. When I saw him the pain was so intense that he could not lie down, and he had passed several sleepless nights. The patient had slight fever (100.4° F.). On examination a small polypus was found in the posterior and lower quadrant of the membrana tympani, covered with a little pus. Over the prominent short process of the hammer there was a small perforation about 2 mm. in diameter, very much as in Case I. In this there was likewise a drop of pus. It is necessary to state that the otorrhea had stopped, or was very scant for some time. The ear was cleaned, and the polypus scraped

away in great part with a curette. The perforation in the upper part (in Shrapnell's membrane) was washed out by means of Hartmann's canula. This was not sufficient; it was necessary to use bent probes (sharp and blunt ones) and forceps to remove the large flakes which appeared in the opening. In this way a large quantity of dense white scales was removed, which showed the characteristic lamellated arrangement and the pearly luster. Having removed this, steam was applied to the ear, and in a few hours there was a great flow of very offensive pus. At the same time the patient experienced relief.

The ear was cleaned daily in the same way, but in about five days the discharge again decreased, and pain reappeared, especially in the right occipital region, which appeared slightly swollen. In the upper perforation there was some carious bone (malleus?) which seemed to act as an impediment. The perforation was therefore enlarged downward and backward. The opening exposed polypoid masses in the middle ear. The patient improved greatly after this. The opening above was further extended, so as to meet the lower perforation, and the polypi were curetted and treated with absolute alcohol. He continued well for several weeks, during which he used the absolute alcohol. But on June 4th pain again came on, which gradually increased for several days, and the swelling in the occipital region reappeared. The means which had hitherto relieved him failed to give relief, and so he was prepared for an operation.

Operation, June 7th. At the time of the operation the patient was in great pain, and there was great sensitiveness to pressure, especially in the right occipital region, where there was a very general swelling. It was not possible to detect fluctuation with certainty, but I convinced myself that by press-

ing I could force a drop of pus from the perforation in Shrapnell's membrane. It was decided to open the mastoid process first. The surface of the mastoid was found normal, as was likewise the interior. It was opened to the extent (in depth) of about one cm. It was next decided to make a deep incision through the swelling in the posterior portion over the occipital bone. This opened into a large abscess-cavity, reaching far forward under the sterno-cleido-mastoid muscle. The contents were very offensive pus. A careful examination did not reveal any opening in the bone, which it was suspected lay on the inner surface of the mastoid process. The two wounds were united in the deeper parts, and iodoform-gauze passed through from one to the other. After the wounds had been thoroughly disinfected with a sublimate solution they were dressed with iodoform-gauze.

The subsequent course of the disease was very favorable; the wounds closed very rapidly, without leaving a fistula. The middle ear is now clean and dry; the two perforations which were united are now separate again. There is no suppuration. The patient uses instillations of a 2 per cent. solution of salicylic acid in absolute alcohol.

I have related this case to show the danger of small cholesteatomata in the attic. It is impossible at present to extract any cholesteatomatous matter from the upper perforation with the tympanic canula or with the probe. This by no means renders it certain that there is none deposited there, for we know that this matter is sometimes so tough that it cannot be washed out;¹ yet it is probable that we have removed it.

¹ In a case published by Gorham Bacon, the cholesteatoma would not yield even when exposed to a stream of water, and had to be scraped out. (*Arch. of Otol.*, xviii, p. 391.)

Let me mention that we find cholesteatomatous matter in other forms of chronic suppuration of the middle ear, in cases in which perforations exist at other parts beside the membrane of Shrapnell.

Turning now to the pathology of this growth, one will get but little information in text-books. In Billroth's *Pathology*, cholesteatomata are regarded as sebaceous cysts or atheromata, "especially those that are congenital, on the forehead, temples, or face, filled with a milky or light-yellow pulp, which, under the microscope, shows little beside epidermic scales and crystals of cholesterin."¹ This is not the description of the tumor as we now regard it. It is true that Toynbee² looked upon them as such, and believed that they originated in the external auditory canal, but his view has long since been shown to be erroneous.

Virchow³ describes cholesteatoma as an *epithelial neoplasm*, composed of concentric layers of flat polygonal non-nucleated epidermoid cells, covered with an exceedingly fine capsule; a heteroplastic tumor, whether found in the pia mater or in the bones of the skull. Occurring as it does in mesoblastic tissues, he finds it analogous to *epithelial carcinoma*.

Those occurring in the pia mater are now believed to be formed by the proliferation of the subarachnoid endothelium, due to some unknown irritation.

¹ Amer. ed. (1883), p. 753.

² London Medical Gazette, Nov., 1850. Toynbee, *Diseases of the Ear*, 1860.

³ Virchow's *Archiv*, 1855, vol. viii, p. 371; also, *Verhandl. d. Berlin. med. Gesellsch.*, Feb. 13, 1889.

The proliferated cells become flattened by pressure against each other. Those of the mamma, the ovary, and the testicle, develop from the glandular epithelium of these organs.¹

The views concerning the genesis of cholesteatoma of the ear have been widely different. Various observers have attempted to find the origin of cholesteatomata in the embryonic development of the labyrinth from an involution of the epiblast (Boettcher,² Schwartz,³ Mikulicz,)⁴ or, on the other hand, in an involution of epidermis in the first branchial cleft, which develops into the Eustachian tube and middle ear (Kuester).⁵ They would thus be congenital tumors similar in their nature to dermoid cysts.⁶

There is no doubt that Virchow's theory holds good for some cases of cholesteatoma of the middle ear. Of the cases which fall under this head, one recently published by Kuhn⁷ may be mentioned. The patient, aged fifty-one years, had never had any ear-trouble, and had been able to hear well till about one year before he was treated. During this year he had at first tinnitus at intervals, and later

¹ See Glaeser, Virchow's Archiv, Bd. cxxii, p. 394.

² Arch. für Anat. u. Phys., iii, 1869.

³ Krankh. d. Ohrenh., 1885, p. 221.

⁴ Wien. med. Wochenschr., 1887, p. 953.

⁵ Berlin. med. Gesellsch., Feb., 1889; Deutsche med. Wochenschr., 1889, Nos. 11-13.

⁶ As such they were classed by the older pathologists. See Rokitsansky (Allg. pathol. Anatomie), Billroth, and others. True dermoid cysts have been found in the mastoid process. See Steinbruegge, in Orth, Spec. path. Anat., p. 62.

⁷ Arch. of Otol., xx, No. 4, p. 291.

on dizziness accompanying the tinnitus. On his taking a severe cold, pain immediately set in, with fever and great local inflammation. Twelve days afterward he was operated upon, and a cholesteatoma as large as a hen's egg was found filling the whole mastoid process. This, as Kuhn believes, was in all probability a cholesteatoma which originated in the mastoid process.

A view distinctly different from the foregoing is that cholesteatoma is an inflammatory product from the surface of the mucous membrane, which is retained in the spaces of the middle ear, or the cells of the mastoid process, and by gradual accumulation forms the tumor. This is the theory of Von Troeltsch.¹

The difficulty encountered here lies in explaining how a cavity normally lined with a mucous membrane can cast off cells of an epidermoid form, and even more, can take on all the characteristics of epidermis with a well-defined rete Malpighii. How are the products of inflammation changed into epidermoid cells? This has been answered in various ways. Troeltsch believed that the product of inflammation (pus), by irritating the mucous membrane, causes a great production of cellular elements, changed in form by the pressure. There are many objections to accepting this view.

Wendt² answered the questions in quite another manner. He regarded the epidermoid mass as the product of a desquamative inflammation of the mucous membrane of the middle ear; for this

¹ Arch. f. Ohrenh., 1868, vol. iv, p. 97.

² Arch. f. Heilk., vol. xiv.

membrane, as he had found, may take on all the characteristics of epidermis when exposed by a large perforation of the drum-head.

It has recently been shown by Schuchardt¹ and others that analogous changes are found in simple ozena, the ciliated epithelium of the nasal cavity being converted into epidermis. The change of laryngeal mucous membrane into epidermoid tissue (*pachyderma laryngis*) as described by Virchow,² is to be remembered in this connection, as well as the change which takes place in the mucous membrane, when it is exposed to the air, as in rectal or uterine prolapse or in nasal or uterine polypi: the part exposed to the air becomes hardened and epidermoid.

A novel explanation has been offered by Lucae.³ Finding cholesteatoma commonly associated with aural polypi, he was led to believe that there was a proliferation of epidermis on the polypi, and that this, by gradual desquamation, produced a cholesteatoma. In certain cases described by Kuhn,⁴ the cholesteatoma was found attached to the floor of the middle ear. It is supposed that these may have been produced in the manner described by Lucae. Another fact bearing on this theory is the discovery by Moos and Steinbruegge,⁵ Schwartz,⁶

¹ Referred to by Schmiegelow, Arch. of Otol., xx, p. 254.

² Deutsche med. Wochenschr., 1887, p. 694.

³ Arch. f. Ohrenheilk., vol. ii, p. 305.

⁴ Ibid., xxvi, p. 63.

⁵ Arch. of Otol., xi, p. 376.

⁶ Arch. f. Ohrenheilk., vii, p. 304.

and Weydener,¹ of cholesteatoma pearls in the substance of polypi of the middle ear.

It may not be improper to mention here that Politzer has found cholesteatoma pearls in the substance of the mucous membrane in chronic inflammation of the middle ear, and that he believes that some large cholesteatoma may arise from these.²

New light has lately been thrown upon this subject by the researches of Habermann³ and Bezold.⁴ It is shown that when large perforations exist, and especially when the drumhead becomes adherent at the edges of the perforation with the inner wall of the middle ear, or when the tip of the handle of the malleus becomes adherent to the promontory—the prominent portion of the inner wall, which lies opposed to it—(conditions which are very common when the perforations are large), the epidermis or external layer of the drum membrane “gains ascendancy over the mucous membrane, and extends with much greater rapidity over the entire district.”⁵ This is analogous to the development of epidermis in the bladder, urethra, and kidney from a vesical fistula after an operation for stone.⁶

This fact, which is now accepted by many, is explained by the peculiar lateral growth of the epi-

¹ Arch. of Otol., xiv, p. 77.

² See his text-book.

³ Arch. f. Ohrenheilk., xxvii, p. 42; Naturforscher-versammlung in Heidelberg, 1889.

⁴ Zeitschr. f. Ohrenheilk., xx, p. 5; Arch. of Otol., xix, No. 4.

⁵ Bezold: Archiv. of Otol., xix, p. 242.

⁶ Case of Marchand, see Glaeser, Virchow's Archiv., Bd. 122, p. 40.

dermis of the drumhead and external auditory canal, which is seen in the slow migration of blood-specks from the center to the periphery of the drum or the formation of long, rolled-up ribands (Bezold), or of "a membranous diaphragm" in the auditory canal at a distance from the drumhead (Buck)—¹ both being shed epidermis, which owe their form to the "surface motion" peculiar, so far as is known, to the epidermis of this part. The proof that epidermis may extend from the tip of the handle of malleus into the antrum²—the most common seat of cholesteatoma—and give rise to such a growth was furnished by a pathologic specimen of Habermann.³

Bezold,⁴ who accepts this view of the migration of epidermis from the external auditory canal into the middle ear, has lately extended its significance. He is convinced that simple tubal catarrh is frequently the cause of retraction and perforation of Shrapnell's membrane, a fact pointed out by Walb.⁵ He believes that the edges of such perforations adhere to the walls of the space within (Prussak's space), and that extension of the epidermis over the walls of these spaces will follow, the cavity will be filled by desquamation—in short, the nucleus of a cholesteatoma is formed. It increases in size, and extends into the antrum. Thus Bezold explains the fact that the antrum and upper part of the middle ear are often the seat of cholesteatoma, and

¹ Manual of Disease of the Ear, p. 98. New York, 1889.

² A cavity above and communicating with the middle ear.

³ Loc. cit.

⁴ Loc. cit.

⁵ Arch. f. Ohrenheilk, xxvi.

the other fact that cholesteatomatous matter was found in almost all of his cases of chronic suppuration with perforation of Shrapnell's membrane. He does not insist upon this being the only manner in which cholesteatomata are formed, but he holds that many are produced in this way.

Politzer believes that the tendency of the epidermis to extend into the middle ear is much greater at the periphery of the drumhead than in the center, and he calls attention to the fact that cholesteatoma is more common when the perforations are peripheral than when they are central. He describes several pathologic specimens which sustain this view.¹

There are, then, various ways of explaining the presence of epidermis in the middle ear. It is certain, however, that this alone does not furnish the explanation of the growth of cholesteatoma, but that, as Steinbruegge² suggests, there are other unknown conditions necessary for their development.³ Steinbruegge believes this factor to be a chronic dermatitis. This would ally the affection with desquamative inflammation of the auditory canal and the drum membrane.

If we bear in mind the cases of cholesteatoma that have been reported, without any history of previous inflammation, while, on the other hand, it

¹ *Wien. med. Woch.*, 1891, No. 8.

² Steinbruegge: *Orth's Spec. Path. Anatomie*.

³ A number of cases have been published (Schwartz, Politzer) in which epidermis lined the middle ear, but which showed no trace of cholesteatoma or desquamation. See Politzer, *Wien. med. Woch.*, 1891, No. 9.

is certain that many owe their origin to inflammatory affections of the middle ear, we will hesitate to accept any explanation as the only one. As is frequently the case, so here it is probable that the various theories do not conflict, but that each serves as the true explanation for different cases, or as Kuhn¹ puts it: "Cholesteatoma of the temporal bone is either a true heteroplastic tumor, as Virchow believes it to be in all cases, or it may also develop, and perhaps in many cases, in the course of chronic suppuration of the middle ear, from epidermis which has grown into the tympanic spaces from the perforated drum or the external auditory canal, and which has slowly and continually kept shedding its horny layer, thus forming the stratified cholesteatomatous mass." To which I should add: or it may sometimes result from desquamation of the mucous membrane, which has become metamorphosed into epidermoid tissue (Wendt).

Concerning the *symptoms* and the diagnosis of this disease, little need be added to what is contained in the clinical histories narrated. In themselves the tumors are likely to cause few symptoms, as is seen in the case of Kuhn, and in Case III. (In the latter there was pain, but this was probably due to the purulent collection behind the growth which could not find an exit, and to ulceration of the dura mater.) They often tend to perpetuate an otorrhea or cause its recurrence.²

¹ Arch. of Otol., vol. xx, p. 303.

² The compact mass swells when placed into water. There are cases in which very acute and dangerous symptoms have arisen from getting water or steam in the ear and in contact with the cholesteatoma.

The *diagnosis* can be made when the masses are seen in the middle ear or auditory canal (Case II), or when smaller or larger flakes made up of the characteristic cells are washed out of the middle ear, especially when they are regularly lamellated (Case IV). There are unquestionably many cases of chronic otitis media in which there is slight desquamation of epidermoid cells, but in which cholesteatomata are never formed. Yet I believe that all cases in which such matter is found deserve special attention, and that they must be considered with suspicion when coming from the attic of the middle ear.

The *treatment* has been suggested by what has been said in the clinical histories. It consists in thoroughly and frequently cleaning the middle ear with injections of warm water, which may contain mercuric chlorid (1 : 5000), hydrogen dioxid, resorcin, carbolic acid, etc. The ordinary tip is rarely sufficient to force the steam into the recesses of the middle ear. Special canulas, which are narrow and long and curved at the tip (Hartmann's is one of the best), will enable the operator to reach these parts, even when the perforations of the drum-head are small. In case the opening is too contracted, it must be enlarged. (See Case IV.) When it is difficult to wash out the middle ear through the external auditory canal, we can sometimes succeed with injections into the Eustachian tube, as is recommended by Politzer and others. It is usually necessary to use the probe and the forceps, together with the injection of fluids. Polypi and carious bone must be removed. After the middle ear has

been thoroughly cleaned, it is to be dried with cotton and by inflating air, and this is to be followed by the insufflation of powdered boric acid, iodoform, or a mixture of boric acid and salicylic acid (Siebenmann¹), etc., or the instillation of alcoholic solutions of the same remedies. It is believed by some that we can thus alter the character of the lining membrane, and diminish or prevent the desquamation.

The operation of removing the ossicles has been recommended by Bezold, Stacke,² Kretschmann,³ Kessel,⁴ and others; but Politzer believes that this is indicated only in those cases in which "the greater part of the drumhead is destroyed, and there is only a minute portion remaining attached to the malleus, in which cases the malleus and the incus are of no service in hearing. Extraction of the malleus is indicated in only those cases of perforation of Shrapnell's membrane in which caries of the head of the bone has been determined by examination with the probe, or when hearing is greatly diminished. In those cases in which there is slight deafness (as is often the case in perforation of Shrapnell's membrane), extraction of the hammer is to be performed only under urgent circumstances and threatening symptoms, for there is a possible danger of injuring the hearing." ⁵

¹ Correspond.-blatt f. Schweizer Aerzte, xxi, October; reviewed in American Journ. Med. Sciences, December, 1892.

² Tenth Internat. Med. Congr., Berlin.

³ Arch. f. Ohrenheilk., xxv.

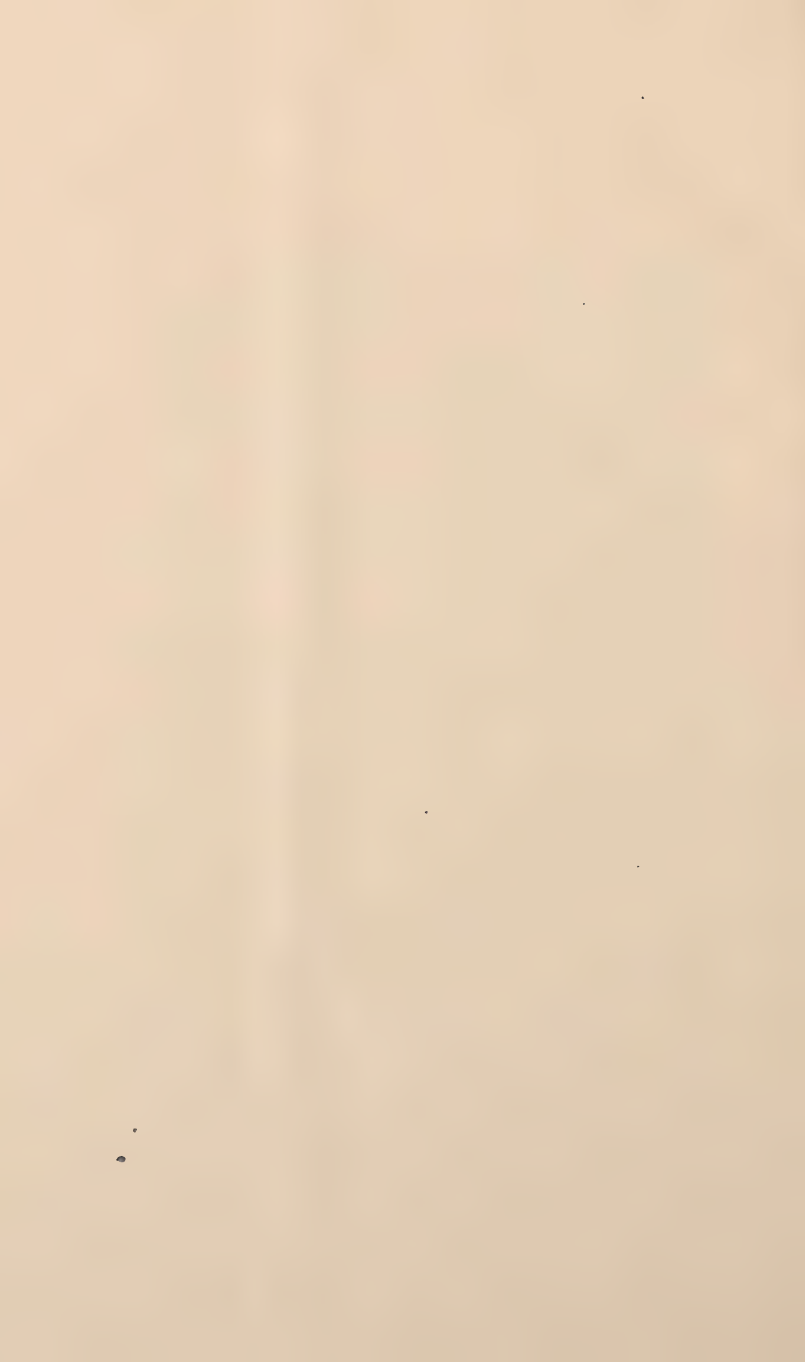
⁴ Ibid., 1880, xvi.

⁵ Politzer: Wiener med. Woch., Nov. 12, 1891, p. 518.

The question of opening the mastoid process is still to be considered. When there is reason to believe that it is the seat of a cholesteatoma, it should be opened. It is difficult to determine this, unless there are local signs. When large quantities of cholesteatomatous matter are found in the discharge, and the process is sensitive to the touch or to pressure, or there is long-continued, deep-seated pain, we can make the diagnosis with much probability. Kretschmann¹ holds that the operation is indicated if the offensive odor of the discharge persists, after removal of the ossicles and irrigation of the attic.

It is important to remember that there is a great tendency for cholesteatomata or cholesteatomatous masses to recur. Patients are to be examined at intervals of a few months for a long time after there is apparent cure.

¹ Arch. f. Ohrenheilk, xxv, p. 165, reviewed in Arch. of Otol., xvii, p. 267.



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